Using Classroom Community to Help Students Get Started

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VIRGINIA TECH

Problem and Background

- Growing interest in computing has led to massive introductory class sizes[1].
- Large lectures can negatively impact students' sense of community.
- Further, limited instructional resources exacerbates the courses' difficulty.
- How do we help so many students succeed on challenging assignments?

Hypothesis

If students are given structure to form groups naturally, the enhanced community will contribute to their preparedness.

Research Questions

1) Do students feel a sense of community?
2) Does structure to form groups naturally make students feel an improved sense of community?
3) Is students' sense of community associated with their preparedness to begin a complex project?

Prior Work

- In general, techniques such as Cooperative Learning and Peer Instruction have shown to have a powerful impact on students pass rates in computing [2,4].

- Micro-Classes (Alvarado [3])
  - Divided large lectures into "Micro-classes" that meet independently with a dedicated TA.
  - Replicates "small-class community effect"
  - Increased student satisfaction
  - Higher perception of community

Context

- Introduction to Programming in Python course
- Non-Computer Science majors in Engineering/Sciences
- Large class size (hundreds of students)
- Baseline semester (Fall 2017)
  - Survey data suggests that many students felt unprepared when starting the final project
- Treatment semester (Spring 2018)
  - A new project was incorporated earlier in the course to prepare students for the final project.
  - However, there were still concerns about how to prepare students for the new, earlier project.

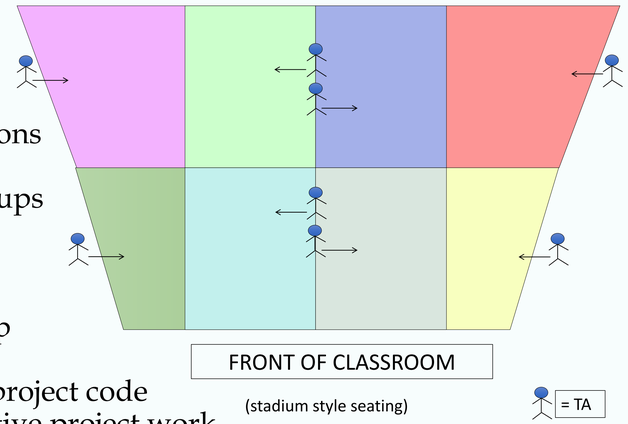
Experimental Methodology

Lecture
- Instructor gave overview of project

Grouping
- Classroom divided into color coded sections
- Each section explicitly assigned TA
- Students encouraged to form natural groups

Paper-based Activity
- Students completed project warm-up
- Work in pairs/triplets/small groups
- TAs address and grade students by group

Project Work
- After the warm-up, students started the project code
- Two class periods dedicated to collaborative project work

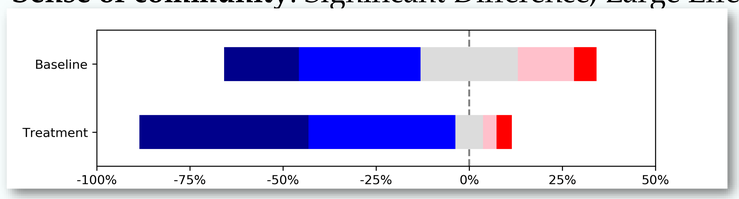


Data Collection

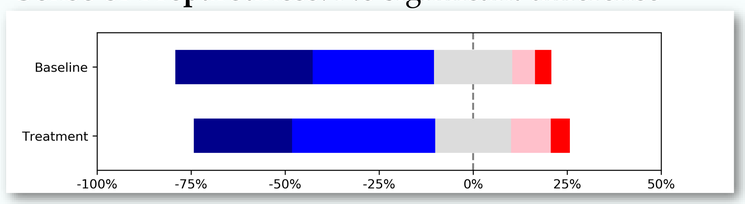
- Same survey for baseline and treatment
- Baseline:
  - After final project
- Treatment:
  - After 2nd project day
- 5-point Likert questions
- Free-response question
- Questions about
  - Sense of community
  - Preparedness
- Self-report data only
- Covered under IRB

Results

Sense of community: Significant Difference, Large Effect



Sense of Preparedness: No significant difference



Baseline N=279, Treatment N=218
*Two-tailed Mann-Whitney U Test at α=.01

Conclusions

- Giving structure to form groups naturally was associated with an increased sense of community.
- However, no increased sense of preparedness.
- Qualitative data suggests students were naturally inclined to seek help of TAs rather than each other.
- Groups were comprised of all novices, therefore the perceived usefulness of their community was minimal

Future Work

Improve Community
- Intentionally arrange groups to maximize distribution of students with prior experience
- Add a senior out-of-class peer to the group
- Increase number of available TA's during class time

Improve Difficulty Slope
- Improve warm-up assignment
- Add another, simpler project

References

[1] National Academies of Sciences, Engineering, and Medicine. 2018. Assessing and Responding to the Growth of Computer Science Undergraduate Enrollments. Washington, DC: The National Academies Press.
[2] Christine Alvarado, Mia Minnes, and Leo Porter. 2017. Micro-Classes: A Structure for Improving Student Experience in Large Classes. SIGCSE'17.
[3] Leo Porter, Cynthia Bailey Lee, and Beth Simon. 2013. Halving fail rates using peer instruction: a study of four computer science courses. SIGCSE'13.
[4] JD Chase and Edward G. Okie. 2000. Combining cooperative learning and peer instruction in introductory computer science. SIGCSE'00.